CACTUS AND SUCCULENT JOURNAL

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FIG. 14. *Ferocactus Wislizenii* photographed by R. C. Proctor near Tucson, Arizona.

CACTUS AND SUCCULENT JOURNAL

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NEW RETAIL LIST

Howard E. Gates has decided to help the collectors by issuing a 1950 Retail List. Deviating from his wholesale business, he is celebrating his twenty-first year in the cactus and succulent growing business with this new list. He hopes that the plants offered will help to stimulate interest and induce better collections. Howard is a past president of our Society, has attended all the conventions, was chairman of the one in Phoenix and will promote the one in Denver. His interest is still in Lower California and he still hopes to return there for some unfinished business; his living collection, in a corner of the 15 acre nursery, of Lower California plants, attracts students from all over the country. Write for your free list now and you might mention your JOURNAL.

TEXAS CACTI AGAIN AVAILABLE

We have obtained a good supply of this 1930 edition of "Texas Cacti" by Schulz and Runyon. When this supply is gone it will again become a rare book item. The 180 page book contains 63 photos of the cacti native to Texas with understandable descriptions. There are chapters on culture, distribution, and enemies, as well as a glossary and list of common names. Well indexed. Paper covers $3.75 postpaid.

NEW CATALOGUE

Cactus Pete, 5440 Valley Boulevard, Los Angeles, California, has just completed his Catalogue No. 3, price 25c. This 48-page book contains valuable information about Epiphyllum hybrids or the "Orchid Cacti." Although the listing is chiefly on Epiphyllums, other related plants are available such as Rhipsalis, Pseudorhipsalis, Disocactus, Chiapasia, Nopalxochia, Lepismium, Heliocereus, and Hylocereus. The catalogue is well illustrated with some color plates. Send for your copy now.

DR. BLANCHARD'S ARTICLES

When such growers as Ed Hummel writes that he appreciates a series of articles, we know that hundreds of others are of the same opinion. We have had many letters of appreciation and comment. The next issue of the JOURNAL will have a discussion by Mr. Brett of England.

MY BUTTON GARDENS

By FLORENCE WAYE CASEBOLT, Berkeley, Cal.

What are Button Gardens? They are exactly what their name implies—tiny bits of nature's own magic and beauty planted with the aid of water repellent glue on large buttons. The size of the button determines the size of the garden. The color, shape, design, or texture of the button suggests the kind of garden to be created. For example, a tawny-colored button may become the floor of the desert. Using several small offsets of the Rat-tail Cactus to simulate giant Barrel Cacti, a few chips of an old brick or tiny pieces of sand-stone, and a colorful plastic charm of a Mexican peon asleep in the sun, will result in a miniature desert scene. A large, flat, green coat button, an interesting piece of rock, a tiny goat, an assortment of the tips of Sedums, and small colorful dried flowers can be combined for a little mountain scene.

To make these button gardens, one needs a good assortment of buttons—large coat buttons for foundations and small silver buttons for lakes, also a good variety of small cacti and other succulents, together with tiny figurines which are to live in the gardens together with some unusually shaped rocks. Flat rocks may be used for desert scenes, jagged ones for seascapes, smooth ones for walled gardens, and those with holes for caves. Bits of broken mirror may be used for ponds and lakes. Tiny pieces of well-washed drift wood, shells, seaweeds, lichens, seeds and seed pods, Brazilian straw flowers, and dried pink buckwheat add variety to the tiny landscapes. Collecting the material gives one an acute perception for seeing some of nature's tiny products.

Put a little water repellent glue such as DuPont's Household Cement at the base of each plant, figurine, rock, etc., and place each one carefully using tweezers, bobby-pins or any small instrument. A bit of "Plasticene" or

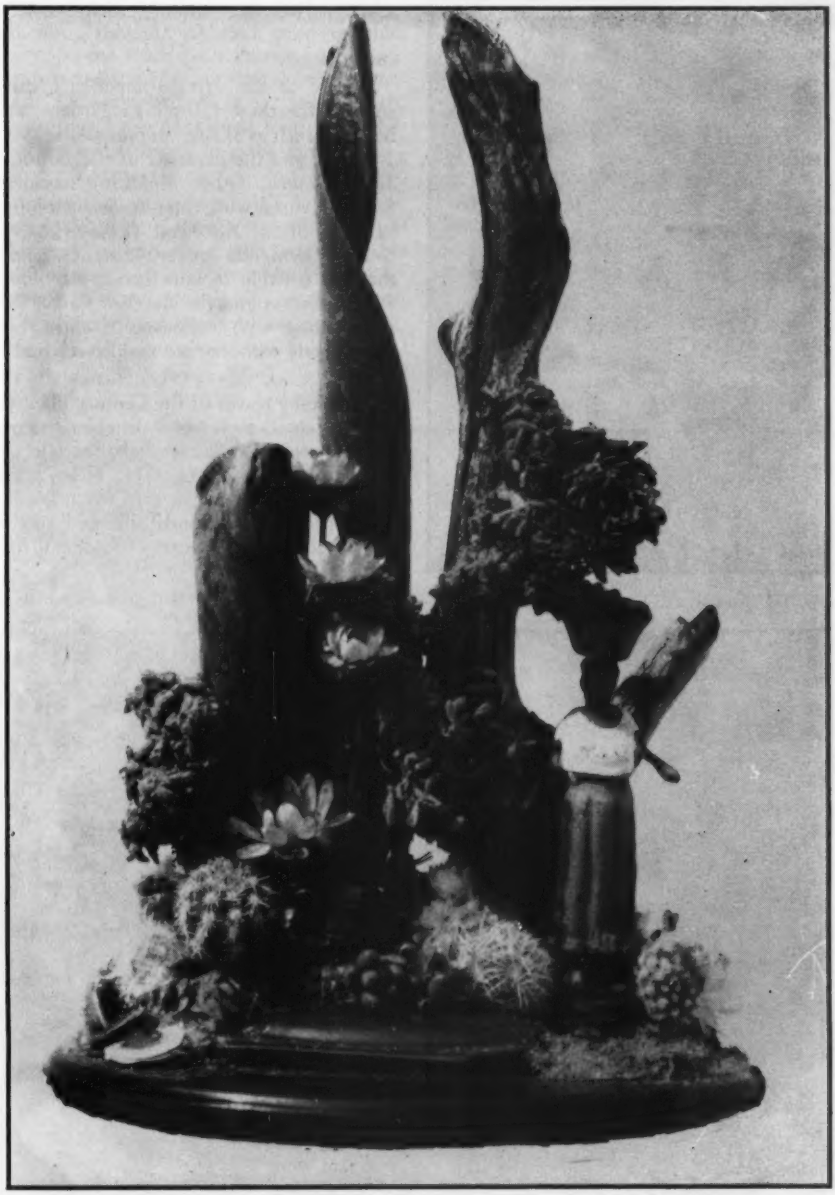


FIG. 15. This is not a large arrangement—only a button garden enlarged. Color and a variety of material are harmoniously combined.

modeling clay may be used with the glue to help support a shell or wood back-drop. As in flower arrangements, be sure to cover all props or mechanics by a bit of sand, tiny pebbles, planting, etc. For example, sprinkle a little sand on wet glue for realism. A few holly-hock seeds for stepping stones could be added; these seeds make perfect lily pads when painted green.

While the little gardens are being made, a good sense of proportion or scale must be uppermost in one's thoughts or the whole illusion, as looking through the small end of a tele-

FIG. 16. The Author and her greenhouse.

scope, is lost. A button garden can be made with seeming limitless horizons as in any medium of art.

A few of the living components, especially suitable for these Lilliputian gardens, are tiny Sedums, such as *Sedum moranense, Sedum dasyphyllum,* and the plantlets of the Boston Bean, *Sedum Stahlii.* Other interesting succulents are Sempervivums with their spider webbing, tiny plantlets of the Air Plant (*Bryophyllum*), and *Crassula tetragona* for jungle scenes. Small cacti that are suitable include *Echinopsis multiplex,* Peanut Cactus and the Rat-Tail Cactus. By experimenting with various cacti and other succulents, one soon discovers which are best adaptable.

The fleshy leaves of the Century Plant may be cut into small pieces and dried in the oven or over a register. These make excellent backdrops for some gardens. Thin pieces peeled off the skeletons of dead desert cacti make "out of this world" backgrounds and add lots of atmosphere for the creation of Cactophile Button Gardens.

Button gardens are also free of weeds but at

FIG. 17. Inside the greenhouse showing tiny offsets of the Peanut cactus and bowls of Houseleeks.

times are attacked by pests such as the mealybug. It is surprising how these gardens survive and grow. Those made with Peanut Cacti have been known to last a year but they do need some attention. Occasionally a light sprinkling with an eye dropper or a dampened tooth brush is sufficient since succulents do exist under conditions of great dryness.

To my constant amazement, the button gardens are making new friends in all walks of life. They are often welcome bedside companions in children's hospitals, for elderly shut-ins, and especially for convalescing service men. Button gardens travel great distances by airmail, boat, train, and automobile. They are especially popular in hospitals, garden clubs, cactus societies, philanthropic organizations, Red Cross benefits, button-, hobby-, and flower-shows, Girl Scout and Camp Fire group meetings and as miniature collector's items.

Publicity has appeared in "Believe it or Not," newsreels in Canada and England, a number of magazine articles, radio broadcasts (late ones in Amsterdam, Holland—AVRO) and in the booklet "Button Gardens and How to Make Them."*

Many people have learned to observe and appreciate much of nature's smallest handiwork while searching for materials. There is unending pleasure in Button Gardening.

* Booklet is available for 50c from the author or Box 101, Pasadena, California.

FIG. 18. Button gardens arranged for children. Exact size.

KEEPING UP WITH THE SPINES
G. L. Berry and Other Cactophiles

Mrs. W. N. Montgomery of Pacific Palisades, California, has developed a novel way of propagation for her seedlings and cuttings by using them to make dish gardens of various types. A sort of hobby within a hobby and a useful one at that. The following is a description of her methods: "The reason I root cuttings, start seedlings and other new succulents (including cacti) in dish gardens in preference to other plants, is because from a cultural standpoint, this method is more successful for me, and from an artistic standpoint, it brings plant propagation into the decorative field. This method has made it possible for me to bring indoors for the winter, samples of all grounded succulents which might not survive the winter. It has also made it possible for me to add to my collection by mail during the dormant season of many of the succulents. The success of this method is probably due to control of moisture and the ease of handling.

"I use glazed and unglazed containers, with and without drainage, the standard soil mixture of top soil, leaf mold, sand and charcoal, sometimes adding bonemeal and lime for the plants that like it. Succulent seeds are broadcast between actively growing 'other succulents' and covered with charcoal. The established plants provide the shade and protection required, and their condition acts as a moisture gauge. Cuttings are dipped in minimum Vitamin B-1 solution and then in charcoal before being planted. Watering of all dish gardens is as follows: If both plants and soil look dry, give a moderate amount of water. If the plants look all right, but the soil looks dry, check the condition of the soil beneath the surface before watering and then, if needed, water lightly. If the plants look shriveled and the soil is not dry, move the dish to a cooler location, out of the sun, and if the weather is warm, cover the soil surface with wax paper and spray the plants with clear water. All plants that are particularly subject to rot are banked with charcoal and if they have any parts which would rest on the soil, thin pieces of rock are slipped under them. Liquid fertilizer is used monthly on all plants showing active growth.

"To avoid labelling individual plants, a simple sketch of each dish is made and filed under the name or number of the container used for the dish garden. My specifications for dish garden containers are very simple. Any container which is from two to four inches deep with straight or only slightly flaring sides can be used.

"Most of my dish gardens are plant arrangements rather than landscapes, with only an occasional decorative rock for ornament, but I do use some landscapes to show off the smallest plants. The plant arrangements are usually graduated in height from side to center or from front to back. The landscapes are usually somewhat Mexican or Oriental in character with an occasional tropical scene for variety. And now a few hints to show what is needed to make up a landscape. When combined with figurines about two inches or less tall, a four-inch *Kleinia Anteuphorbium* cutting becomes a *Carnegiea gigantea;* a half-inch section of *Kleinia articulata* becomes a watermelon, tiny Echeveria become full grown shrubs, as do the small Kalanchoe seedlings. *Bryophyllum tubiflorum* hybrid (see pg. 106, "Succ. for the Amateur") cuttings of *Portulacaria afra* and *Crassula tetragona* and *Sedum multiceps* are among the many excellent trees. Landscapes are fun!

"In large dish gardens, plants with varying light and water requirements can be successfully combined by the arrangement of the plants in regard to the light they will receive and by watering the individual plants according to their requirements rather than by watering the entire dish at one time."

I think all plants in a collection should be named. Give them the scientific name if possible and the common name, too, if you like. The scientific name is like your name "Richard Jones" and the common name is like the nickname "Dick" so use both if you like. BUT for goodness sake don't use a label more conspicuous than the plant.

I saw a fine collection of Mammillarias not long ago, all correctly named and arranged very neatly on the shelf. But the labels were three inches wide and two inches high and fastened to the pot in such a manner that they stood up behind the plant and larger than most of the plants.

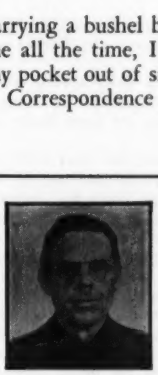
There was no difficulty in reading the names but it looked like a collection of labels rather than a collection of cacti. The plants were completely minimized and the labels emphasized.

I like to have all of mine labeled (and I wish they all were) with correct names but the label can be small and it can be hidden behind the plant or behind the pot. You can always turn the pot around if you forget the name and have to look. My name is "Berry" but instead of

carrying a bushel basket of berries around with me all the time, I carry a small name card in my pocket out of sight.

Correspondence invited.

DR. G. L. BERRY
Lawton, Oklahoma.



QUESTIONS and ANSWERS

Conducted by HARRY JOHNSON Paramount, Calif.

Question: My cactus has some white cottony bugs* on the ends of the spines. What are they and what shall I do? Mr. R. M. Murdock, Alabama.

Answer: The pest attacking your plants is the Spine Mealybug. This seems to attack only cacti. The insect itself is a small, lens-shaped, lead-gray bug generally found in the crown among the tender, growing areoles though at some seasons it seems to retreat under the plant. At certain seasons the egg masses or cocoons are placed near the tips of the spines. They are quite white and prominent and when seen there is no difficulty diagnosing what is wrong. When many are feeding on a plant they will either kill it or so disfigure and retard it as to ruin it. There is often a yellow discoloration at the crown. The best treatment is to spray with Volck Spray preferably in combination with Red Arrow or other rotenone or pyrethrum spray. Since the mealybug has a waxy, water repellant covering, the oil sprays are almost necessary to get a quick, penetrating kill. Generally one good spraying will control it to the point where Red Arrow or other similar sprays will finish the job. One sad fault of oil sprays is that where the beauty of the plant lies in its powdery white covering, as for instance *Lemaireocereus Beneckii* or *L. pruinosus,* it will turn the plants green. Among succulents, often the Cotyledons and Portulacaria will drop their leaves after Volck spraying. However, one often has a Hobson's choice of losing the plant by bugs or disfiguring it by the spray. On the great majority of plants the Volck may be used without damage two or three times a year which is ample to control pests.

Question: How do I get my Night Blooming Cerei and Echinopsis to flower? Mrs. Isabel B. Mathey, Ga.

Answer: The Selenicereus, Hylocereus and Eriocereus flower on old wood not on the young growth. This growth must be strong and vigorous to support the huge flowers produced—often a foot across. During the summertime, when growing, they should have the benefit of sunlight—direct, not through a window. The main object is to get thick, heavy growth—not long, slender whips. In late summer cut down on the water so the plants will thoroughly ripen their growth. Feed them lightly in late spring and early summer. They don't need too large a pot if properly fed. After the growing season, the stems may be looped or coiled about a trellis to keep them within bounds. The Echinopsis flower very easily, but to get the most from them they also like direct sunlight. You will be astonished at amount of bloom if they can be kept outside in summer protected from heavy, soaking rains. Don't keep them growing too late in the fall but see that they get a three month or longer rest in winter. If reasonably dry they may be stored away in a frost free attic or basement where there is some light. If the temperatures are reasonably low (40-50° or even less) they will not grow and thus etiolate.

Question: When should the winter resting period be over for my cacti? Mr. L. C. Swenn, Michigan.

Answer: Under cultivation, one must take into consideration his own local climate conditions and the conditions under which he is growing his plants. If you have a nice "Orlgt" greenhouse you would be able to start spring growth perhaps a months earlier than if you were growing your plants in an east window. If you are in a foggy, cold climate you will naturally wait until spring is really under way rather than to start your plants into growth with weeks of dull, cold days ahead. Normally I wait till winter is definitely on the wane even though the weather may be warm and sunny. Not much could be gained by rushing ahead and quite definitely much can be lost if ill fortune should favor you with a long, cold, wet spell right after your plants had been watered or perhaps replanted. No, don't be in a hurry to get going. Know your own climatic limitations. You will be surprised how little you actually know about them unless you have been keeping records.

Question: I am planning an outdoor cactus garden. How shall I prepare the soil? Mr. R. C. Clover, Los Angeles, Calif.

Answer: The first thing is to not put a pile of sand in your garden and then proceed to plant. A good strong loam soil is best. The conditions in an outdoor garden and those of a

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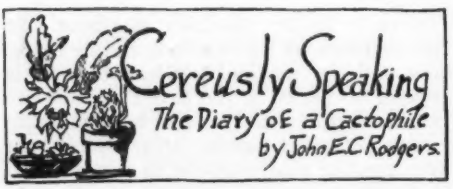
*See "Cacti and Succulents and How to Grow Them," pg. 50.

window garden are as different as night is from day. Very sandy soils dry out rapidly and if the soil is mounded up as it usually is the plants may suffer from excessive drought. A good dressing of leafmold and cow manure should be spaded in, thoroughly incorporating it. If your soil is quite sandy, as it is in many localities, the cow manure will help materially. See that rain drains away without standing too long. If you have what we in the west call "adobe" you can still grow some very fine cacti. In fact one of the largest gardens in the west is on an adobe hillside. One of the finest small collections I have known was on quite heavy brown loam and was top-dressed with an inch of cow manure. It remained in good shape for many years. Another, after the plants were set out, was top-dressed with an inch of yellow decomposed granite from the Hollywood hills. It also remained in fine condition for several years. But remember that sand piles are no place to grow good collections of cacti. If you have a very sandy location you can grow good cacti by adding cow manure and watering a little more frequently.



In January I wrote my column about the borderline succulents of the Bromeliaceae and included several genera. This time I plan to write about *Aztekium Ritteri* (Echinocactanae), *Chiapasia* (Cereeae), and *Disocactus* (Cereeae). *Aztekium Ritteri* is one of the smaller cacti which has been given generic rank because of its flower, otherwise it could be an *Ariocarpus*. My plant is a single head, two-inches across, and with seven ribs. The ribs resemble over-lapping olive green, thickened (cooled) molten rock, sunken at the center from which short, thick, cream-colored "spines" protrude. *Disocactus Eichlamii* resembles *Rhipsalis Houlettiana* in growth habits with dark green stems branching from the round stems. *Chiapasia Nelsonii* has the same lush green growth but does not put out long round stems like *Disocactus;* it branches from the base and at the lower areoles of the older stems.

Although *Aztekium Ritteri* is the only species in the genus, *Disocactus* has two known species—*D. biformis* and *D. Eichlamii*. *Chiapasia* lists only one species. These plants are all rare in collections and as such attract attention whenever displayed.

When these plants are better known, the local or common names will begin being used as I've found there are few cacti that remain scientifically named. *Chiapasia Nelsonii* is known as the "Morning Glory." When I first saw *Aztekium Ritteri* it was dubbed "Aztec Rose," which, no doubt, came from the *Ariocarpus* having been called *Roseocactus* by Berger in 1936.

All three of the plants bloom in early spring with the other Mexican cacti. I've not been able to change the time of flowering whether they are kept moist or dry.

Aztekium Ritteri has the tendency to scurf over at the base as it grows older the same as *Ariocarpus*. It is well to water from the side or from the bottom because the "lime salts" race up into the body of the plant and cover up the green if watered near the low set body of the plant. Both *Chiapasia* and *Disocactus* have a tendency to die back at the tips. This is due to a fungus and can be controlled by Bordeaux or some other copper base spray. I keep mine away from the Epiphyllums such as *Nopalxochia phyllanthoides* (*Deutsche Kaiserin*) and other plants of similar growth which have the reputation for being fungus carriers.

Aztekium Ritteri was first found in Nuevo Leon in Northern Mexico about 1929, but it has since been found in Guatemala also. The habit is "dry" part of the time but it stands liberal watering when growing.

Disocactus and *Chiapasia* are both tropical types of Epiphyllanae. The latter grows in the mountains around Chiapas, Mexico. I use the same rich soil mixtures for both plants as for my Epiphyllums with a leached cow manure top dressing after growth starts. *Aztekium Ritteri* stays in good health when given a sand and powdered slate mixture of soil. I use old roofing slate for this but was almost sold on the idea of having a large piece of slate shipped with my order. It sounds convincing doesn't it? Mexican slate is where it grows and therefore it needs it—well folks, it's growing in Ohio slate and it's doing fine.

All three of these plants are window garden material. *Disocactus* and *Chiapasia* both got their start in my window with the African Violets, Orchids and Billbergias. They grow to be moderate size but never take up more room than Deutsche Kaiserin. *Aztekium,* even when it has several heads is still within the limits of the window sill gardener. So do not fear the worst—they'll grow if given the care you give your Epiphyllums and Echinocacti.

Most people think that the flowers of *Disocactus* and *Chiapasia* are disappointing. Not to me, they're not. *D. Eichlamii's* "bright red" flowers have a short tube with narrow spreading petals which stay open during the day when the light is strong. *Chiapasia Nelsonii* has a rose-pink, open, bell-shaped flower. There are a few petals on the throat similar to the Christmas Cactus. The petals are much wider than I had expected from earlier writings but I'm a Rhipsalis fan and admire smaller blooms, so I may exaggerate.

Aztekium Ritteri is my plant of the month because it is small and compact, grows in a special soil and needs little attention. The blooms, slightly larger than the head of an old fashioned match, are more white than pink. Even in the brightest light they remain bell-shaped. The buds appear at the center where a nest of blunt spines and yellowish brown "wool" form at the blooming time. The plants are usually shipped with a shortened tap root and much wrinkled appearance. It takes the plant about two months to root in dry slate-sand mixture to which a very light watering is given once a week. Its rarity, form, and special cultural needs all add up to the plant of the month.

JOHN E. C. RODGERS
1229 8th Street, Lorain, Ohio.

For good illustrations see: *Aztekium Ritteri*—"Glossary of Succulent Plant Terms" pg. 15. *Disocactus biformis*—"Epiphyllum Handbook" pg. 121. *Chiapasia Nelsonii*—"Epiphyllum Handbook" pg. 123.

TERRESTRIAL BROMELIADS

And their association with cacti and the other succulents

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By MULFORD B. FOSTER

Fig. 1. *Cephalocereus fluminensis.* A Brazilian cactus that turns its head from the sea to bear its flowers and red fruit shielded in a white wool pseudocephalium. On these same rocks grew the Bromeliad, *Billbergia amoena.*

Fig. 2. Rare Dyckias. In the foreground on the left is the "priority" *Dyckia Fosteriana* with its whorl of platinum grey leaves which produce a stem of golden flowers. On the right is *Dyckia minarum,* one of the smallest of this genus being two to three inches in diameter. A delightful miniature.

TERRESTRIAL BROMELIADS

And their association with cacti and the other succulents

By MULFORD B. FOSTER

Of the terrestrial types of bromeliads, Dyckias have been the best known among collectors. Horticulturally, they have been used, I believe, more than any other terrestrial bromeliad.

In the book, "Succulents for the Amateur" there is but one page devoted to the bromeliad family and on that page there are just three species mentioned, *Dyckia sulphurea, D. rariflora* and *Hechtia Texensis.* All three of these are worthwhile subjects and do very well in almost any succulent garden in the south of Florida or California and for indoor gardens, protected from severe freezing; they do well in pots.

Generally speaking, the Dyckias are not difficult subjects for the collector and do not require much pampering. Most of them enjoy a slightly acid or neutral soil and I have found that they are quite happy growing in a leaf-mold and sand mixture with pulverized dairy manure or any good organic fertilizer. They all enjoy full light conditions and while they are quite drought resistant they can take plenty of water when the drainage is good.

All of the Dyckias have stiff, spine-edged succulent leaves, most of the species having green leaves. The flowers range from sulphur yellow to brilliant orange and generally appear in the spring. Unlike their cousins, the pineapples, Dyckias always send their flower spike laterally from the side of the plant. The axis remains sterile and continues to grow year after year. The larger types often form a yucca-like trunk, but the smaller species cover the ground in mat formation.

Most of the Dyckias are native to Brazil but neighboring South American countries have a few species. They are generally found growing on or in the crevices of rocks.

In private collections the two most common Dyckias have been *D. sulphurea* and *D. rariflora*. The large botanical collections have had a few additional ones such as *D. multiflora*, *D. altissima*, *D. frigida*, *D. Montevidedensis* and *D. remotiflora*.

From my collecting in Brazil I have introduced to this country the following known species: *D. coccinea*, *D. minarum*, *D. microcalyx*, *D. leptostachys*, *D. sordida*, *D. ferruginea*, as well as three of my new discoveries, *D. simulans*, *D. ursina* and *D. Fosteriana*, plus several new hybrids. Of the earlier introductions from Europe, the first two Dyckias, (*sulphurea* and *rariflora*) have been the only ones suitable for small collections because of their convenient size. However, from my own collecting, the *D. coccinea*, *D. minarum*, *D. leptostachys* and *D. simulans* are all of a small enough size to interest the succulent collector limited to pot culture.

Dyckia minarum is one of the smallest sized plants in the group. I have seen this plant which averages two to three inches in diameter growing in rather large beds. When in bloom, with its six to eight inch spikes of orange-yellow flowers, it is an interesting subject. The green leaves are stiff and the plant is rather compact.

Dyckia coccinea is quite a hardy plant and grows in much more compact masses than many Dyckias. When grown in the open the individual plants do not show up as distinctly as most Dyckias. The lepidote olive green leaves, four to seven inches long, are narrow with an upright growth; the red-orange flowers are on a tall, 18 inch spike, and they add a nice note of color in the early spring and summer. This species grows natively in open rocky fields and is exceptionally drought resistant.

Dyckia microcalyx is a medium sized plant but certainly the most floriferous Dyckia I have ever had. It produces from one to three tall branched flower stalks each year with hundreds of yellow flowers thereon; it makes an excellent outdoor rock garden subject. The mass of curved, narrow, heavy spined leaves is a real addition to any succulent collection.

Dyckia leptostachya has been at home in our garden from the moment of its arrival from Brazil where we found it on rocky slopes in far off Matto Grosso. It grows in sun or shade, but of course blooms best in full light. It has fewer leaves than most of the Dyckias. They vary from maroon to green and most of the plants have produced at least two spikes of flowers in succession each spring. It reproduces by shooting out underground stolons and new plants will continue to develop around the matured plants. The flowers, on an eighteen to twenty-four inch spike, are of a rich orange in color. I have seen solid mat beds of these Dyckias eight to ten feet in diameter.

Dyckia frigida, an early bloomer coming from February to June, withstands quite a cool climate and dry conditions in sun or shade. The plants are from twelve to eighteen inches in diameter and the branched flower spike, at least three feet high, carries a good supply of orange yellow flowers. The green leaves are glabrous.

Dyckia ursina is well named. The flower spike and even the sepals and part of the petals are covered with a brown wool an eighth of an inch thick resembling a bear's fur. It is a bit large for pot culture but as a rock garden plant it will stand extreme conditions. While I found it in the tropics it grew high in the Brazilian mountains of Minas Geraes and the cold, raw, windy

morning convinced me that it had not grown the wool covering for naught. Also the mid-day sun in that area was so severe that I am sure the wool covering has still another purpose. The branched flower spike is often three to four feet high and the flower is a lovely orange almost covered with brown wool.

Dyckia Fosteriana, according to Lad Cutak of spiny "chatter" fame, is the gem of the genus. And indeed it is a priority plant for its spiral whorl of grey leaves appear to be made of platinum and its brilliant flowers of gold. As a pot plant it will have no rival within the Dyckia tribe. The plant is three to four inches in diameter.

My Dyckia hybrid "Lad Cutak" is the most vigorous grower and bloomer of any of the Dyckia family, and it exceeds in size either of its parents. Several more of my Dyckia hybrids, not yet described, will be worth while new comers.

HECHTIA

These spiny, Dyckia-like bromeliads are less well known than Dyckias, although they are almost all natives of our neighboring country, Mexico. There are four Hechtias in the United States and one in Guatemala.

In appearance the well-armed Hechtias resemble very closely the spiny Dyckias. In fact, most of them could not be distinguished from Dyckias except by the inflorescence. They generally grow in much greater masses than the Dyckia colonies that I have seen. Most of them are also highly xerophytic and enjoy extremes in heat as well as fairly low temperatures. While the Hechtias are of more interest to the succulent specialty collector, most of them are a bit too large for the collector who has little space. The flowers are generally borne on long branched spikes and for the most part are rather inconspicuous, being without showy colors.

Fig. 3. *Dyckia ursina* has a flower spike covered with a brown wool resembling a bear's fur which protects the flowers from extremes of cold and heat.

The Hechtias have one interesting character which is unusual in the family of bromeliads. While the flowers are monecious, having both pistil and stamens, however, each species has what we might term masculine and feminine forms. In other words, in the male form the pistil is not fully developed enough to function. In years past in many of the species, because of the different vegetative appearance in the two forms, each sex was named as a separate species.

Many of the Hechtias could hardly be noted for showy beauty, but one outstanding exception is the lovely Mexican species, *H. capituliguera*. The stiff, spiny, succulent leaves of this plant when in full sun, radiate an almost transparent amber color and lend a beautiful note to the rock garden. This species as well as *H. stenopetala* are two Mexican species that should grace every southern garden.

The four Texas species, *H. scariosa, H. Ghiesbreghtii, H. glomerata* and *H. texensis*, are all deserving of a place in any succulent collection. I know of no plants that ask for less attention than many forms of these Hechtias.

While most Hechtias are moderate in size, ranging from about eighteen inches to twenty-five in the spread of the rosette, with a flower stalk from one to four feet high, I discovered, (in Mexico in 1935) a giant among the Hechtias. Its rosette spread is over five feet across and its flower stalk nearly eight feet high. This proved to be a new species, *H. melanocarpa* (recently described by Lyman B. Smith), with a peculiar characteristic.

It has a central inflorescence! All other Hechtias, Deuterocohnias and Dyckia that I am familiar with have a lateral inflorescence; several other genera have this characteristic and I wrote a paper on the subject of "Lateral Inflorescence in the Bromeliaceae" in the National Horticultural Magazine for January, 1945. While this article was on the press, the giant Hechtia which I had had growing in my garden since its collection ten years previous decided to produce its first bloom. And from the center axis of the plant, (which no self-respecting Hechtia should do) upsetting completely my statement that "the genera . . . regularly producing a lateral inflorescence . . . are confined (in Bromeliaceae) to Hechtia, Dyckia, Deuterocohnia and Encholirium."

Now for a trip back to Mexico to find more Hechtias which will prove or disprove that *H. melanocarpa* is the only exception.

In general, the spiny leaves of the Hechtias lend themselves fittingly to rocks and blend happily in association with cacti and other succulents, thereby adding one more interesting form to the desert garden.

ANANAS

Much better known on the table than in the flower garden, and of course the best known of the terrestrial bromeliads, are the pineapples. The Indian name for pineapple in Brazil where it is native, is abacaxi (a-bäk-a-she). If it is a pineapple which is not edible, they may call it either "Gravata" or "Caraguata," these terms being used, mostly, for spiny plants that might be utilized for their fiber.

Gardens in the sub-tropics and tropics should have many more bromeliads and certainly more of the genus Ananas which are not only decorative but useful in being edible. Their great long lasting fruit makes a delightful decoration in the garden that can grow them. This pineapple fruit head rises out of the center of the spiny leaves on a strong stalk which holds the fruit proudly erect. The fruit is topped with a small rosette of leaves which form a miniature of the mother plant. And this "top" in turn if planted grows and becomes a mother plant which produces fruit, fulfilling its cycle of maturity.

Nature, in this instance, does not limit her means of reproduction to one method. She does not risk the chances of the top of the fruit being destroyed so the plant also sends out from the base suckers, which root and soon grow into another plant. In general, the other terrestrial bromeliads grow and reproduce very much like the pineapple. Most other forms in this family send off side

Fig. 4. Two Melocacti growing in the shadow of the large tank epiphyte, *Hohenbergia littoralis* on the shore of Bahia, Brazil.

Fig. 5. *Ananas ananasoides* var. *nana*, the smallest pineapple in the world, makes a delightful decorative feature in the rock garden.

shoots soon after the fruit matures and within a year or so the old matured sections gradually die.

Ananas ananasoides var. *nana*, the smallest pineapple in the world, is not edible. The fruit, from one to two inches long has the delicious pineapple fragrance, but is small and too hard to eat. It is useful, however, because the plant itself with its miniature, long lasting pineapple makes a delightful decorative feature in any collection. It is easily grown and much quicker to fruit than the common pineapple, *A. comosus* (sativus). I have planted the top of this dwarf pineapple and had fruit the following year. The plant suckers readily and grows in interesting clusters with as little attention and care as almost any plant one could think of. In Florida it does well in poor sandy soil or in the well fed heavier soil sections of the garden. It is happy in shade or full sun. Its adaptability is its one great attribute carried over from its native habitat which is in the wild lands of the cooler sections of Brazil; being able to grow also in the cerrado (tired land), the areas where everything seems to fight for its existence, gives this little pineapple a high ratio of adaptability.

Ananas ananasoides, typical form, is about twice as large as the "nana" or dwarf form, but in growth and habit it is quite similar to the miniature form. Its reddish bracts on the fruit stem which is topped with the colorful flower head followed by fruit make it an added sparkling note to any tropical garden.

FIG. 6. *Ananas bracteatus* produces brilliant red fruit and brilliant red bracts on the stem giving the plant much color for many months. "Pina" cloth is made from the leaves of this rank growing pineapple.

Ananas bracteatus is not only a beautiful and decorative plant for the garden but it bears a very good eating fruit as well, and certainly requires little attention. The red fruit and brilliant red bracts on the fruit and stem remains on the plant for months. We found these growing wild in many sections of Brazil where they were always a source of food to the natives, but we never found them grown commercially. One reason for this is that they grow quite a large top and send out many off-shoots from the bottom of the fruit, so they would be awkward in shipping. The flavor is a little more tart than our familiar commercial pineapple. Its channeled leaves have been used for a very strong fiber.

We found a variety of this species growing wild in the state of Sao Paulo, Brazil, called *A. bracteatus* var. *albus* with a fruit which is a pale greenish white. This variety is not the best for eating because of its seeds but it is, nevertheless, interesting.

Ananas bracteatus var. *tricolor* is the most brilliantly colored and decorative of any of the varieties of the species. It grows larger and is much more spectacular when in fruit than the *Ananas comosus* (sativus) var. *tricolor,* which too is a colorful variety. This latter variety was a great favorite among horticulturists fifty or more years ago and was seen in almost every fine plant collection of this country and in Europe, but it has almost disappeared from horticulture, at least in this country.

Somehow, in Brazil, it took on the name of *Ananas cochinchinensis.* We found a plant so labelled in the Jardim Botanico in Rio and wondered how this native Brazilian species ever received a name that associated itself with Cochin-China, a country thousands of miles from the native home of the Ananas.

Fig. E. *Pseudananas macrodontes.* The false pineapple flower head produces a mass of lavender flowers held above delicate pink bracts which remain long after the fruit is formed. This "pineapple" does not have the typical leafy top.

Either of these two plants would be an adornment to any collection with its colors of green, white, yellow and red stripes but they are scarce and will be scarce for sometime due to its slowness of reproduction. There being such a small percentage of chlorophyll in the leaf, the plant does not reproduce itself very rapidly, so it remains a rare and much prized specimen. Their fruits are quite as delicious as the species form in each variety.

PSEUDANANAS MACRODONTES

Here is a pineapple which is not exactly a pineapple, but according to its name, Pseudananas, shows it to be a false pineapple. This species *macrodontes*, we found in central and southern Brazil growing both on the coast within sight of the Atlantic ocean and then far back into the northwest in the great state of Matto Grosso.

This "false" pineapple does not sucker at the base as does the true pineapple, but it sends out long underground stolons.

It enjoys a partially shaded area in which its stiff barbed leaves eventually develop into an almost impenetrable thicket. The leaves are generally much longer than those of the common pineapple.

The succulent flower head produces a mass of lavender flowers held above delicate pink bracts which remain long after the fruit is formed. Although its fruit has a nice flavor and is interesting, it is not grown commercially. The fruit can be easily distinguished from the other pineapples as it does not have the typical leafy pineapple top.

PUYAS

Puyas have been classed by Dr. Lyman B. Smith as the earliest type of bromeliad. Their original home being in the high Andes most of them are lovers of altitude and cool temperatures. Only a few species have been introduced into horticulture and no doubt the finest examples are in California gardens, although I have several Puyas growing in my Central Florida, low altitude garden. A number of Puyas have been grown in English gardens as rockery plants; they could and should be successfully used in a greater climate range of gardens than any of the bromeliad family.

These densely rosulate, spiny leaved plants with their stately cluster of flowers range in size from one to thirty feet in height. Comparatively few of the species are small enough for the average succulent collector, but I feel quite certain that southern rock gardens will in the near future greet them with considerable interest.

Puya alpestris, a native of Chilean Andes, has given the traveler a tremendous thrill when beholding its great mass of blue-green flower clusters.

The caption under the color plate in the ILLUSTRATED LONDON NEWS for August 14, 1937, describes these unusual flowers as "three-petalled goblets of waxy, silken texture of an unearthly blue-green. Standing up in the center is a cluster of brilliant orange anthers, and in the middle of these is a tufted stigma of bright lettuce-green velvet."

It is a plant reported to be of easy cultivation . . . the only plant which I have, recently acquired, has not yet had time to bloom, but I am anxiously awaiting that day.

Puya alpestris was discovered by Mr. Clarence Elliot who also brought back from his Chilean expedition of 1927 the magnificent and sensational *Puya coerulea.*

Puya spathacea, being a native of Argentina where it is fairly cool, can adapt itself perfectly to the light frosts of Florida and California and it makes an excellent garden subject. The stiff grey-green tomentose foliage makes a bold more upright rosette than in the Dyckias or Hechtias.

A great branched inflorescence, sometimes as tall as four feet, makes a brilliant display with its scarlet to pink stem and scape bracts. Bright pink and green flowers add to the delightful and conspicuous color scheme of this desert plant.

It likes a sunny, well-drained habitat and one need not be greatly concerned about its care; once established it seems to thrive.

DEUTEROCOHNIA

My collecting trip to Brazil introduced me to two genera unfamiliar to me except in name, that can very happily be adapted to our succulent gardens in the south with sub-tropical climates.

Deuterocohnias and Encholiriums resemble the Dyckias or Hechtias so much that without flowers it is almost impossible to tell them apart.

Like the Dyckias, the Encholiriums and Deuterocohnias are semi-succulent and are very efficient xerophytes enduring terrific conditions. Because of what seems like adverse conditions these bromeliads have developed hardy qualities and they thrive in such profusion that it is almost impossible to climb the rocky slopes where they grow; they are as well armed with spines as any cactus I know.

In evolutionary development and thereby appearances, the Deuterocohnia without bloom is very close to the Puya. But in bloom the distinction is at once apparent. Puyas having a spike of relatively compact flowers is quite unlike the branched scape of the Deuterocohnia which holds many less densely distributed flowers.

Deutercohnia Meziana is an oddly unique bromeliad; its branched five to seven foot flower stem continues to bloom for years from the same stalk. No other bromeliad (and so far as I know, no other plant, possibly the Hesperaloe) has this strange habit of blooming so many successive years from the same flowering stem. I found this flowering stem of the Deuterocohnia, also possessed the unique phenomenon of a cambial layer, similar to a characteristic of dicotyledons rather than the monocotyledons to which group the Deuterocohnias belong.

After its long trek from the Matto Grosso in Brazil to its resting place in our Florida garden the Deuterocohnia now seems perfectly happy in its new surroundings.

Fig. 8. *Deuterocohnia Meziana* is an odd Bromeliad which blooms for years from the same branched inflorescence which has a cambium layer characteristic to Dicotyledons. The plant enjoys dry rocky slopes.

ENCHOLIRIUM

Encholiriums resemble the Dyckias and Deuterocohnias so very much that the bloom is really the only distinguishing feature and the bloom on *Encholirium horridum* is unusually distinctive with its many branched inflorescence. It was one of my new species and the first known Encholirium with a branched flowering stem, and also the first one to be found growing so near the sea as it was literally within a stone's throw of the ocean. It is a huge plant with whorling spiny leaves which cling to smooth, granite, perpendicular rocks just above the water in Espirito Santo.

The other new species which I discovered on our Brazilian trek was named in honor of Dr. Hoehne, *Encholirium Hoehneanum* found in the Bahian interior. It is a silver,

gray whorl of hooked, spiny leaves, which should be an effective addition to our rock garden plantings by contrast of this greyish foliage against the rocks or near greener foliage of the other succulents.

The extreme xerophytic qualities of the Encholiriums make them adaptable to warm climates and they ask for the minimum

Fig. 9. *Encholirium horridum* is the first known Encholirium having a branched flower stem; it grows near the sea on smooth granite perpendicular rocks. Getting through a growth of these is a horrible experience! Note the Cerei growing with them.

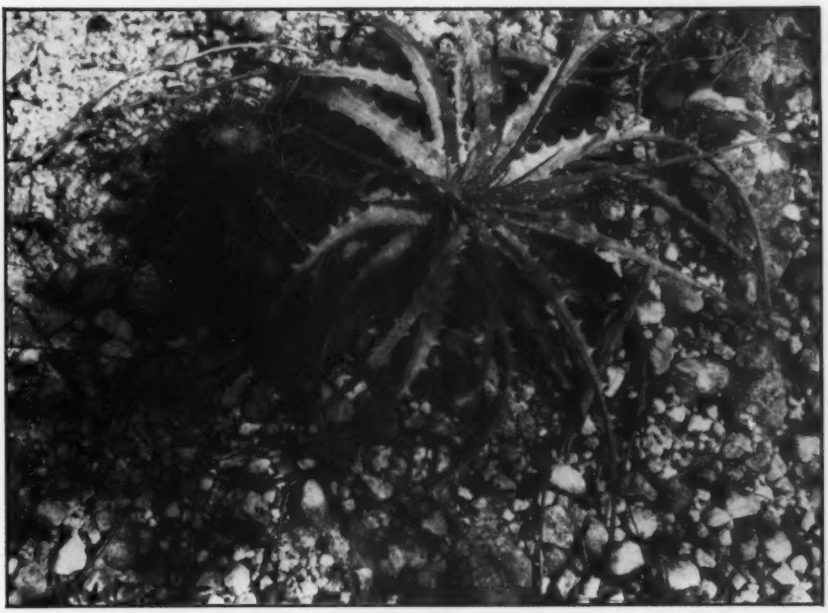

Fig. 10. *Encholirium Hoehneanum* is a silver, gray whorl of hooked spiny leaves resembling a Dyckia, but having quite a different inflorescence. Note the Melocactus close to the *Encholirium*.

amount of care. In this dry land, cacti are close neighbors to many bromeliads, especially Encholiriums. As a matter of fact I cannot recall having seen many Encholiriums growing wild except in company with cacti. This applies to both the coastal type and those growing back in the dry interior.

ORTHOPHYTUM

Orthophytum foliosum is a new species of a small and little known genus. This plant was growing in clusters on rocky ledges in a cool, mountainous section of Brazil with its nearest plant neighbors being orchids, the huge *Certapodium Andersonii* and *Cattleya Warneri*.

Until the blooming stage is reached, Orthophytums resemble Cryptanthus in growth form, but at blooming time the Orthophytums reach eighteen inches in height with many clusters of white flowers hugging close to the main stem in ascending sections. The leaves are thorny, light green and swirling, so that the whole effect is quite decorative and by contrast to other succulents is most interesting.

NEOGLAZIOVIA

Neoglaziovia variegata, a monotypic terrestrial bromeliad is, for many reasons, a "must" in every succulent collector's garden. It will grow "anywhere" in our warmer climates. Its home is in the dry, hot, catinga (similar to our mesquite land), in granite soil; it seems to thrive on adverse conditions side by side with cacti and other succulents, and was indeed found growing in the company of *Arrojadoa penicillata*. Amusingly, they continue to be neighbors in our Florida garden.

From the visual point of view it is striking; distinctive horizontal, light grey bands on the almost cylindrical or terete tall, straight grey-green leaves make it a succulent one does not overlook. The "whip-like" leaves range in length from 2 to 15 feet,

Fig. 11. *Orthophytum foliosum.* Until the blooming stage, this plant resembles Cryptanthus in growth form which is most decorative beside other succulents.

Fig. 12. *Bromelia balansae* (serra) makes an excellent rock garden plant; it likes full sun, rocky soil and can take plenty of neglect. In bloom it is something to rave about.

Fig. 13. *Neoglaziovia variegata,* the whip-like, fiber yielding Bromeliad which grows in granite soil, has the lovely cactus *Arrojadoa penicillata* as "rock garden" companion.

producing long, strong fibers, hard to equal, when properly treated; in Brazil it is being commercialy propagated for this excellent fiber.

The lovely flower spike is not like any other familiar bromeliad scape; it is sometimes as tall as the leaves consisting of rich coral coloration in stem and bracts which hold purple flowers that turn to dark royal purple with age.

I am particularly fond of this odd, unique bromeliad but unfortunately I know of no one who has any plants to share as yet.

BROMELIA

Because of their size and very spiny leaves no members of the genus Bromelia have found favor as a house plant, but the species *Bromelia balansae* has become increasingly common in Florida gardens and somewhat evident in California gardens. It makes a particularly excellent rock garden or mountainside plant. It likes full sun, rough rocky or sandy soil and can take plenty of neglect!

When not in bloom it certainly resembles a pineapple plant with plain green leaves edged with effective hooked spines. It gives plenty of massive foliage feeling in the garden and is harmonious in form with cacti and the numerous desert succulents. When in bloom it is something to rave about. The signal that it is going to put forth a bloom comes when the center terminal leaves start

Fig. 14. *Arrojadoa penicillata,* the charming "pencil" cactus of Bahia, Brazil, grows in dry, granite soil, a close companion of Neoglaziovia. The reddish-brown pseudocephalium which holds dark pink flowers is delightful.

"blushing" actually turning brilliant red, gradually increasing in perimeter and intensity until, up from the very center pushes a massive white head containing many small but beautiful maroon and white flowers.

Fig. 15. The giant terrestrial *Bromelia karatas* has leaves which often reach six to nine feet in length and is almost too rank for the ordinary garden. Unlike most of the Bromelias this species produces its flowers in a dense, flat almost stemless head. The huge nest of purple flowers later produce large, four-inch yellow fruits which are edible, and can be made into a drink or dulce.

Out of this whitish flower head darts flame-red "spears," the inflorescence bracts, which add much brilliance to the already magnificent spectacle. No adulations are too extravagant for the wondrous beauty of *Bromelia balansae*, "Heart of Flame." To see the miracle of its bloom unfold over a period of several weeks is a joy no plant collector should miss, but alas, its beauty must be confined to warm climate outdoor gardens, although it easily withstands light frosts.

Its orange colored fruits are used in producing an interesting drink.

B. balansae is generally listed and sold as *B. penguin* or *B. serra.*

The variegated form of this bromelia called *B. tricolor* is one of the most outstanding and spectacular plants among the terrestrial bromeliads. The green and white variegation on the spiny pineapple-like leaves has a flush of pink at all times and then has the final display of the indescribable eruption of color at the blooming and fruiting stage.

In conclusion, I find that the great intriguing variety of terrestrial genera has hardly been touched in my descriptions, and words never convey the whole picture of the full beauty of a living bromeliad. But this introduction, will, perhaps serve as an awakener to the fact that bromeliads definitely have a place with cacti and succulents in the tropical or sub-tropical rock garden. They have an unusual contribution to make in beauty of form and flower and they provide a wide range of interest for an inquiring observation into their little known habits.

THE SIGNIFICANCE OF SOIL REACTIONS

By LOUIS E. BLANCHARD, A.B., M.D.

Soil reactions play vital roles in plant nutrition and at various physiological ranges, exert beneficial influences on plant and bacterial life. The mechanisms and theories described in this article are applicable to all soils, but whether the quality is suitable for cacti or other types of plants, is a question of composition. A brief explanation of some of the terminology will facilitate the reading of this article.

All matter is composed of molecules and these tiny invisible particles represent the smallest possible amount of substance which retains identity in character with the substance in mass. Molecules may be further divided into atoms at which stage the properties of the original mass is lost. For example a molecule of sodium chloride (salt) is composed of one atom of sodium (Na) and one atom of chlorine (Cl). Neither of these atoms have the properties of salt but can combine to produce this compound. It may be expressed as follows:

Na (sodium atom) + Cl (Chlorine atom) = Na Cl (sodium chloride)

Atoms may acquire positive or negative electrical charges and are then designated as ions. The electrically charged unit may be a single atom, or group of atoms acting as a whole. For example:

$$H^+ + OH^- = HOH$$

Hydrogen ion + Hydroxyl ion = Water

A molecule of water consists of one atom of Oxygen (O) and two atoms of Hydrogen (H).

It is through ionic exchange in the soil that new compounds are made available to plants and because of this property, ions are called active. A molecule is inactive but by dissociation can produce active ions. For example:

Na Cl (salt) $\rightarrow$ Na^+ (sodium ion) + Cl^- (chlorine ion)

By hydrolysis is meant a chemical reaction in which one of the reactants is water. In such a process, a salt and water react to produce an acid and a base. For example, sodium carbonate will react with water to produce sodium hydroxide and carbonic acid. Sodium hydroxide being a strong base will ionize more actively than the weak carbonic acid, and the domination of the OH ions will produce alkalinity. The reaction may be shown as follows:

$$Na_2CO_3 + 2\ HOH \rightleftharpoons 2\ Na\ OH + H_2\ CO_3$$

Sodium carbonate + water $\rightleftharpoons$ sodium hydroxide + carbonic acid

A chemical reaction may be acid, neutral or alkaline. Excess hydrogen ions (H^+ ions) are associated with acidity, and excess hydroxyl ions (OH^- ions) with alkalinity. At neutrality, the H^+ ions and the OH^- ions are equal in number. Pure water is a neutral solution. Even a neutral solution such as water will carry an infinitesimal amount of H^+ ions and OH^- ions and the weights of these ions are extremely small compared to the weight of un-ionized water. For practical purposes, we will assume that the weight of the H^+ ions is one ten-millionth of a gram in a liter of water. In mathematical terms this would be the equivalent of raising 10 to the 7th power or multiplying ten by itself, seven times. If "p" represents the power to which 10 has been raised and "H" stands for hydrogen, then the intensity of the H^- ion concentration will be pH 7. Inasmuch as the concentration of H^+ ions and OH^- are identical, this value represents a constant and we may definitely state that any solution with a pH of 7 is neutral. It is apparent that in any solution containing H^+ ions and OH^- ions, the product of their concentrations can not exceed 10^{-14} ($pH^{-7} \times pH^{-7} = pH^{-14}$).

The pH scale is the gauge by which we measure the range of acidity or alkalinity and it extends from 0 to 14. A soil which has a pH of 7 is neutral. Readings above pH 7 to pH 14 show progressive alkalinity and readings below pH 7 to pH 0 indicate increasing acidity. The pH determination of a soil requires no knowledge of chemistry. By the use of a wide range indicator paper (pH 1—12), accurate readings can be easily obtained. Moisten a small amount of soil to be tested, with distilled water, wet the indicator paper and compare the color change with the indicator color chart for pH readings.

The fine clay and humus particles in soil, loosely hold electrically charged H^+ ions and OH^- ions. When the H^+ ions are in excess, acidity exists. The salts of calcium, magnesium, potassium and sodium are basic and if present in sufficient quantity to produce an excess of OH^- ions, will produce alkalinity.

Physiologically a pH of 4 represents about the extreme intensity of acidity some plants can tolerate. In the alkalinity range, very few plants will grow above a pH 9. The optimum pH range for most plants is from moderate acidity to slight alkalinity, which is expressed by a pH range from 6.2 to 7.2. At these reactions the various mineral salts essential to plant life are more or less soluble and therefore available.

In measuring the pH of a soil, the reading obtained represents the weight of hydrogen ions per liter of soil extract. Suppose the weight of hydrogen ions is one ten-thousandth of a

gram. This number will be equivalent of raising 10 to the fourth power or multiplying four 10's. If "p" stands for the power to which 10 has been raised and "H" for hydrogen, then this soil extract has a pH of 4. If the soil extract contains one millionth of a gram of hydrogen ions per liter, it will be equivalent to raising 10 to the 6th power and the pH will be 6. It is obvious that the *lower* the pH value, the *higher* is the acidity. The pH value indicates the intensity of an acid and not the amount. It is analogous to temperature readings. The temperature of a glass of water and a barrel of water may be identical, but it is obvious that the amount of heat measured in calories will be much greater in the barrel of water because of its greater heat capacity. The same logic applies to various soils. Two sandy soils may have the same pH values, but if one soil contains twice as much acid clay as the other, it will take twice the amount of lime to reduce the acidity 1 pH unit.

Soils offer more resistance to pH changes than the test solutions indicate. For example a weak acetic acid solution ($HC_2H_3O_2$) will be partially ionized to H^+ ions and $C_2H_3O_2^-$ ions (acetate ions). The percentage of these active ions when the solution is at equilibrium is called the *constant*. If a basic reagent such as sodium hydroxide (Na OH) is now added, it would use up the hydrogen ions, and some of the unionized acetic acid molecules will ionize in sufficient amount to restore the solution to its original constant of acidity. This ability to maintain a steady acidity for a prolonged period is termed—reserve acidity. Alkaline solutions of weak bases such as ammonium hydroxide react in an analogous manner to maintain a reserve alkalinity. Such mixtures are called buffer solutions.

The buffer capacity of such solutions has a stabilizing effect on soils. Wide pH fluctuations would have drastic effects on soil properties. It would create excesses or deficiencies of plant foods by rendering them too soluble or insoluble and may also convert insoluble toxic salts into soluble ones. Such sudden wide fluctuations would not provide an opportunity for plants to adjust themselves to a changed environment. Such changes would also be very detrimental to the beneficial soil bacteria and to the organisms living in symbiosis with the plants.

By way of comparison with human physiology, it is interesting to note that blood is also a buffered solution. The bicarbonates in the blood represents the main supply of base to neutralize acids formed during metabolic activity. In health this acid-base balance is kept remarkably constant with pH of 7.35. The symptoms in certain diseases are due to profound disturbances in acid-base balance. In diabetes, the oxidation of blood sugar is diminished due to pancreatic disease, and the combustion of fatty acids then take place. These fatty acids are incompletely burned or oxidized, with the production of toxic products as acetone, diacetic acid and beta-hydroxybutyric acid. The excessive loss of water in this disease with its associated depletion of alkali reserve, produce a toxic condition known as acidosis.

Soils under cultivation produce considerable carbon dioxide (CO_2) through the decomposition of organic material and respiration at the roots. The carbon dioxide combines with water to produce carbonic acid and hydrogen. The hydrogen ions replace the reserve basic ions, and soluble bicarbonates are produced, mostly in the form of calcium bicarbonates. As soluble calcium salts are lost by leaching, and since CO_2 production continues, there will be a continuous depletion of calcium ions in the soil and the pH will be on the acid side. The constant loss of calcium (lime) may produce deficiency diseases. A low pH indicates the need of lime in the soil.

In desert soils there is a considerable accumulation of the carbonate salts of calcium and magnesium. Where rainfall is scarce, vegetation and organic matter will be correspondingly low, and the acid producing carbon dioxide will be limited. Under such conditions, the pH will be on the alkaline side. Lack of leaching will be another contributing factor in keeping the basic content high.

When the pH of a soil shows very strong acidity, the salts of iron, aluminum and manganese become soluble and active (ionized). As aluminum salts are toxic, considerable damage may be done to certain plants. Increasing the pH to near neutrality or slightly above will cause these salts to be precipitated into insoluble forms. Recently in our greenhouses a section of chrysanthemum plants developed a marked chlorosis. Many leaves were almost white. Our soil analysis showed all the nutrient elements in adequate amounts. The tests also indicated the presence of iron, manganese and magnesium. There was no evidence of infection. The soil reaction showed a slight alkalinity with a pH of 7.4.

The signs were indicative of deficiency. We added sulphur and by its oxidation to sulphuric acid, the soil became moderately acid with a pH of 6.2. All subsequent growth was normal and the green foliage showed health and vigor. In our opinion, the plants were in need of iron salts and these became available when the soil was made acid. Nutrients in soils are of no value unless they are present in available forms.

It is also possible to develop deficiency signs from the lack of available trace elements such as copper, zinc and boron in strongly alkaline soils. When trace elements are absent in the soil, their deficiency signs cannot be attributed to soil reactions.

Excessive uses of chemical fertilizers may be factors in deficiency diseases by producing unfavorable reactions. The prolonged use of sodium nitrate, by making the soil too alkaline, will create insoluble iron salts and chlorosis will develop. The use of ammonium sulphate which leaves an acid residue will correct this condition. Both of these salts, in addition to their value for plant nitrogen, may also be employed to maintain proper acid-base balance.

Phosphorus is sensitive to soil reactions and although we are accustomed to apply superphosphates rather liberally to soils, considerable amounts of this fertilizer, may become fixed. In strongly acid soils (pH^4—pH^5), complex phosphates of iron and aluminum are produced and because of their insolubility, are unavailable to plants. In alkaline soils, various complex calcium phosphates are formed, ranging from very slight to complete insolubility. It has been shown that polybasic acids of phosphorus such as orthophosphoric acid, H_3PO_4, will easily release one atom of hydrogen in ionization, but that further ionization to furnish the remaining hydrogen ions becomes progressively difficult. Molecules of orthophosphoric acid that originally held 3 hydrogen atoms, now possesses the same force to hold a lesser number of hydrogen atoms, thus making ionization more difficult. The subject of phosphorus availability to plants is a rather complex one and it appears that a soil pH within the range of 5.6 to 6.5 will satisfy the physiological needs of phosphorus nutrition. It is obvious why the percentage of phosphorus in commercial fertilizers is high. So much may so easily become unavailable that the danger of excess is rather remote.

Although mineral soils are rich in potash, it is largely unavailable. Organic matter in soils with its production of CO_2 and other acids will have a tendency to produce potassium solubility. Potash deficiency in crops is a frequent occurrence, and when this takes place it is necessary to add soluble potassium salts such as potassium chloride or potassium sulphate. Unleached hard wood ashes may contain up to 7 per cent of potash and 2 per cent of phosphoric acid. It also carries as much as 35 per cent lime and would therefore be intensely alkaline.

PH has a marked influence on nitrates in the soil. Nitrification and nitrogen fixation are accomplished by bacteria and these organisms flourish at a pH of about 6. By their activity millions of tons of nitrogen are annually fixed for nitrate production. Pathogenic or disease producing fungi will thrive in any range of soil reaction but are predominant in a low pH range because there is less competition from bacteria at this level. A highly acid soil may become a disease producing medium for many plants.

Certain plants can only thrive in soils of very strong acidity. Such plants seem to be immune to fungi and chemicals that would be destructive to plants growing in the medium pH range.

Azalea plants will thrive only in a soil of strong acidity. Such plants require liberal amounts of iron salts and at a pH range of 4 to 5, such salts become freely soluble and available.

The bacteria that oxidize sulphur to sulphuric acid are extremely facultative and thrive in any pH range. Because of their remarkable indifference to pH changes, sulphur may be applied liberally to soils and highly acid reactions produced when necessary.

Acidity may be intensified by the use of certain fertilizers. For instance, ammonium sulphate which is rich in nitrogen, leaves a residue of sulphuric acid. For plants such as azales and rhododendrons, that require copious amounts of iron and strong acidity, ferrous sulphate is definitely indicated. This salt not only furnishes the essential iron but by hydrolysis also leaves a sulphuric acid residue. Although aluminum sulphate is frequently used to increase acidity, it is generally agreed that this is a toxic salt to plant life in the medium pH range. It should therefore be used judiciously. However, it is well to remember that when aluminium sulphate is used in the medium pH range, its toxic effect will only be a temporary one as it will quickly be dissociated through ionic exchange and hydrolysis, leaving an acid residue. This situation is entirely different from a soil with strong acidity where soluble toxic aluminum salts are continuously produced. In the physiology of plant or animal life, the prolonged presence of toxic substances in small amounts definitely produces more damage than a heavy dose at rare intervals. In warm soils where chemical activity is increased, the exposure time to toxicity will even be less. Adequate acidity may be produced by mixing acid peat or acid leaf mould in the soil.

In my opinion, aluminum sulphate is toxic to plants that grow best in the medium pH range. The mere fact that plants such as azaleas and rhododendrons grow only at low pH levels where essential iron salts are freely available and where also soluble aluminum salts are abundantly produced, would indicate that these aluminum salts are not toxic to plants that thrive in low pH levels. It is logical to assume that these plants have so physiologically adjusted

themselves as to use aluminum salts in their economy. A similar adjustment exists in marine plant life. Sea water contains about 3 per cent sodium chloride. Such a brine would be fatal to terrestrial vegetation but marine plants thrive in it.

When alkalinity in soils is essential, this can be accomplished by the use of a fertilizer such as sodium nitrate. The residue sodium, in this case will be definitely alkaline. Bone meal, being rich in calcium will also have a similar effect but is rather slow in action. The simplest way to obtain neutrality or alkalinity is by the addition of lime in the form of the oxide, hydroxide or carbonate.

It is well to remember that lime in the form of calcium sulphate (gypsum) will leave a sulphuric acid residue and increase the soil acidity in spite of the fact that it also increases available calcium in the soil. Calcium chloride behaves like calcium sulphate in this respect, leaving an acid residue in the form of hydrochloric acid.

Sand in soil is almost chemically inactive but facilitates drainage and aeration by making it loose and friable. A sandy soil having little organic matter will have a small ionic exchange capacity and become acid sooner than heavier soils.

Cacti and other succulents are frequently grown in the same pot for many years. Liberal applications of soluble fertilizers may cause root damage and also build up such a high osmotic pressure in the soil from excess soluble salts, that water absorption by the root hairs becomes difficult. Poor drainage is the cause and leaching is the cure of this condition. In our experience, the proper use of chemical fertilizers on desert plants, yields excellent results.

This article deals principally with the significance of soil reactions. There are other important physiological factors but it is obvious that the mere presence of plant nutrients in the soil is of no value unless they are present in available and non-toxic forms.

CORRECTION

In the last issue of this Journal (dated January, 1950), the following typographical errors occur in the article entitled *System of the Mesembryanthemaceae:*

In the first par. for (Comp. Botan. Archiv., etc.), read (Vgl. Botan. Archiv., etc.).

On page 20—the 3rd line from the end of the introductory matter, for Aicoaceae, read Aizoaceae.

On page 21—under Subtribe 6 Psammophorinae, for stempless, read stemless. Under Subtribe 16 Gibbaeinae for wiht, read with.

On page 23—under Tribe 6 Dactylopsideae, the genera represented in this tribe were omitted and these are:

Aspazoma N. E. Br.
Dactylopsis N. E. Br.

It might also be mentioned that Sukkulentenkunde I (1947) is the year-book of the Swiss Cactus Society (Jahrbücher der Schweizerischen Kakteen-Gesellschaft).

NOTES ON HAWORTHIAS

By J. R. BROWN

Haworthia Jonesiae Poelln. in Kakteenkunde (1937) 153, fig., in Repert. Sp. Nov. XLIII (1938) 109. Resende in Mem. Soc. Brot. II (1943) 90, fig. 2a.

Plant with slender leafy stems, more or less erect, becoming decumbent in age, 20 cm. or more in length, 2-3 cm. diam., proliferous from the base.

Leaves 1.5-2.5 cm. long, 6-10 mm. broad towards the base, lanceolate to ovate-lanceolate, erect, and terminating in a short pellucid point, becoming brownish in age; the younger leaves lightly incurving; deep green, the young growth pale glaucous green and pruinose; face of leaves smooth, flattish to lightly convex; back rounded and keeled and with obscure, darker lengthwise lines, the margins and keel tubercled with concolorous or somewhat darker tubercles in the middle area of the leaf, the tubercles decreasing to a roughness towards the tip; occasionally a few tubercles also occur in the middle area on the lengthwise lines.

Type locality: Cape Province: Steytlerville. Named after the discoverer Mrs. E. Jones.

The arrangement of the tubercles on the back of the leaves is probably nearest to that of *H. Armstrongii.* The latter, however, is a larger plant in every way and is scarcely or only slightly pruinose and is very obscurely lined on back of leaves.

The white bloom evident, in a greater or less degree, on Haworthias, such as *H. Jonesiae, H. Armstrongii, H. Jacobseniana, H. Herrei,* and *H. Eilyae* is most pronounced on the young growth, and when grown outdoors rain, watering, etc., causes this to disappear to a great extent.

Haworthia Armstrongii Poelln. This Haworthia was described in this Journal, X (1939) 123, and at that time a small plant was illustrated.

It is a vigorous plant and soon forms a large

FIG. 19. *Haworthia Jonesiae* Poelln. nat. size.

cluster of stems, which may attain a length of 20 cm. or more, and a diameter of 3.5-4 cm., the oldest stems being decumbent. It is not only proliferous from the base but is also productive by means of underground stolons.

The leaves are 3-3.5 cm. long, and about 15 mm. broad towards the base; pale glaucous green in color, the younger leaves very glaucous and slightly pruinose; back of leaves acutely keeled in the upper part; the somewhat conical tubercles on the margins and keel shining, whitish or often concolorous.

FIG. 20. *Haworthia Armstrongii* Poelln. nat. size.

SPINE CHATS

LADISLAUS CUTAK

Peter R. O. Bally, botanist of the Coryndon Memorial Museum, Nairobi, Kenya, mentions the most astounding example of the surviving power of a Succulent in his excellent article, "East African Succulents," published in the Journal of the East Africa and Uganda Natural History Society. He came across this astounding example in the Berlin Museum where a seemingly dead plant of "bushman's candle," *Sarcocaulon rigidum,* had been kept there locked up in a drawer for an unknown period, but certainly for several years. It was then placed into a show case at the Museum, and, after having been an exhibit under glass for three further years, it started to emit young shoots. Transferred to the hot-house, the plant continued to develop normally, seemingly none the worse for its long period of apparent death.

* * *

In "East African Succulents," P. R. O. Bally attempts to stimulate interest in collecting and cultivating East African Succulents, and to disprove the often heard contention that they cannot bear comparison with those of other countries. It appears that East Africa has climatic conditions which especially favor the cultivation of Succulents in all but its higher altitudes. The interesting article does not claim to take in all Succulents to be found in East Africa, because the flora is far too imperfectly known, but it does take in most of the known species that have been recorded in literature and in the accessible herbaria. Bally started this series back in August, 1940, and to date six parts have been published, the latest appearing in January, 1946.

Part I takes in the Crassulaceae and discusses such East African genera as *Cotyledon, Crassula, Kalanchoe* and *Sedum.* Only two Cotyledons are known from East Africa and one, *Cotyledon Barbeyi,* is endemic, being one of the most ornamental of Succulents in that part of the world. This vigorous shrub is said to attain a height of seven feet. In Part II (Sept., 1941) the description of additional Crassulaceous plants is continued and shows that a host of Crassulas and Kalanchoes, many not yet in the trade, are native to East Africa. Part II also takes in the Mesembs—four species belonging to the sub-shrubby type with elongated fleshy leaves and two or three succulent herbs of the seashores and waste lands. The Purslane family is also treated, as well as the Passionflower, Goosefoot and Gourd families. These latter families contain, what I would call "Curiosity plants" which we in America hardly know except in literature. Take for instance *Adenia globosa,* this is an immense, shapeless lump, attaining a diameter of six feet or over, which sends out from the upper part long climbing branches high up into trees. Although a relative of the Passionflowers it bears no outward resemblance to these highly ornamental garden vines. Part III (February, 1942) discusses more "curiosity plants" of the Fig, Grape and Dogbane families.

Part IV (June, 1942) takes in the milkweeds, giving a complete survey of the Stapeliads found in Kenya, Tanganyika and Uganda. Six genera are represented with a total of twenty-seven species. Part V (November, 1943) discusses other milkweeds, such as the Ceropegias and Sarcostemmas. When the war broke out further studies were postponed because overseas collections and publications were not available for consultation. Part VI (January, 1946) takes in the Daisy family and discusses the succulent Kleinias, Notonias and Senecios. Further discussions are contemplated but when these will be published is yet uncertain. Peter R. O. Bally ought to be congratulated on this fine piece of work he has done so far and it is hoped that the East Africa and Uganda Natural History Society will publish the entire work in booklet form when completed. Such a pamphlet would prove an invaluable work for the Succulent Plant enthusiast.

* * *

Since Bromels are one of the chief interests of my life and because they are fast becoming established in cactus collections, I think it is appropriate to mention that several more new species have been described by Dr. Lyman B. Smith of the Smithsonian Institution in recent months. In his newest study, the fifteenth of the series, appearing in Contributions from the United States National Herbarium (29:277-316, 1949) Dr. Smith describes thirty-four new species and three varieties from Mexico, Guatemala, Panama, Colombia, Venezuela, Ecuador and the Lesser Antilles. The largest number of these are new species from Colombia collected by Mulford and Racine Foster, whom you all know for their fine book, "Brazil, Orchid of the Tropics" published in 1945. These two indefatigable collectors are now honored by having several bromels named after themselves, namely *Greigia mulfordiana, Greigia racinae* and *Pitcairnia fosteriana.* Another one of our friends, whose comments on plant life in southern Mexico, frequently appear in the CACTUS JOURNAL, is honored by having a Tillandsia named after him, *T. macdougallii.*

* * *

Kalanchoe Robynsiana is a new species recently described by Dr. Raymond-Hamet in Bulletin du Jardin Botanique de L'Etat (Brussel). The description appears in the December, 1949, issue (19:437-441). *Kalanchoe Robynsiana* is native to the Belgian Congo, the type collected in the Haut-Katanga District. The plant possesses erect, smooth, robust stems with narrow obovate, obtuse leaves and corymbose, many flowered inflorescences. It belongs in the same group with *K. Lugardii, K. Dyeri* and *K. Quartiniana.*

* * *

The two largest members of Aloes in South Africa are *Aloe dichotoma* and *A. Bainesii.* It is said that baboons relish the flowers of the former by tearing off the flower spikes and sucking the honey with such rapidity, that they can clear a whole tree in a short time. "Kokerboom" is its native name because bushmen used to make quivers for their arrows from its branches.

IRWIN KROHN CONSERVATORY

Superintendent Clarence A. Stewart made the Cincinnati Times-Star with a fine write-up about the Conservatory. He was standing beside a 20-year old flowering plant of *Crassula argentea* that was nearly six feet high; the flowers last six-weeks—from the last of December into January, and that is quite remarkable for a tub-grown plant.

MEETING OF THE CACTUS AND SUCCULENT SOCIETY OF AMERICA

A meeting of the Cactus and Succulent Society of America, Inc., open to all members, their friends and the public, will be held at 8:00 o'clock on the evening of Friday, March 31, in the Auditorium of Plummer Park, 7377 Santa Monica Blvd., Los Angeles.

This meeting will be of interest to all persons at all interested in cacti, succulents or the desert and its interesting moods as there will be a Plant Forum with plant discussions, colored slides of cacti, succulents and the desert and mountains.

There will also be door prizes, drawings for plants, and cuttings for all who want them. Come and meet your friends and renew acquaintances with others who are interested in this hobby.

COLORED SLIDES

For the use and benefit of the Affiliates and other regular members, we are trying to increase the Society's collection of colored slides dealing with Cacti and other Succulents. Anyone having duplicates or extra slides they wish to give for this use, please contact, or send them to, Mr. Edward S. Taylor, 3036 Nebraska Ave., South Gate, Calif.

Slides should be of good quality, sharp enough so one can recognize the plants. If you do not know the name of the plant shown, please send all the information regarding it you can. Pictures taken in natural surroundings should include the locational data.

There is no reason why every known Cactus and Succulent grown in this country, or any other, should not eventually be represented in this collection for your use.

TO ALL MEMBERS OF THE SOCIETY IN EVERY STATE:

Following up a plan formulated by the Research Board and also in line with the suggestion contained in Dr. Berry's column in the last JOURNAL, the Research Board now proposes that every member of the Society in every State of the Union, try to collect plants of and to photograph every species of cactus which grows in his particular state.

When this material has been collected and photographed, the Research Board requests that part of the material and photographs be sent to them for the preparation of herbarium specimens and also for the preparation of an up to date listing of "What Grows Where," to be published in the JOURNAL.

The important part of this plan is that the member collecting the material, send along the necessary pertinent data, giving exact place of collection, type of soil, altitude and the other items which are shown in the following form:

HERBARIUM OF POMONA COLLEGE

.....

Var.....

State.....County.....

Locality.....

Mt. Range.....Alt.....ft.

Drainage Area.....Soil.....

Veg. Type .....

Slope.....Date.....19....

Collector.....No.....

Many of the members of the Society have expressed a desire to do what they can to help and now such a chance is being given to you so take part in this helpful plan.

If every member of the Society will collect whatever species of cacti they can, growing in their immediate locality and send the material to the Research Board, it will not take long to have a very comprehensive listing of exact localities at which these certain plants may be collected.

Get on the wagon and let us show that members of the Society are enthusiasts in fact as well as in name.

HOMER RUSH, *Research Board Chairman.*
820 W. 115th St., Los Angeles 44, Calif.

RARE BOOK

We offer a single copy of H. Jacobsen's "Verzeichis der Arten der Gattung Mesembryanthemum" as it appeared in Fedde's Repertorium in 1938. This book contains the most valuable list of genera and species of Mesembryanthemums with their synonyms. Price $25.00 (no covers). Box 101, Pasadena, Calif.

FREEPORT CACTUS CLUB

Mrs. August Ottenhausen, Corresponding Secretary, reports the tenth anniversary meeting of their club with twenty-two members present. Mrs. Fred Beightol is the newly elected president and is always most helpful to new members; her collection is outstanding and she "knows her plants." The address of this active club is 733 W. Elk Street, Freeport, Illinois.

Midwest Cactus and Succulent Society

The officers for 1950 are:

President:
John Rodgers, 1229 8th Street, Lorain, Ohio.

First Vice President:
George E. Steward, 12830 Havana Road, Garfield Heights, Ohio.

Second Vice President:
E. J. Fish, Wooster Road, Strongsville, Ohio.

Secretary-Treasurer:
William F. Weber, Middlefield, Ohio